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Chem. 30
Aug., 1969

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DEPARTMENTAL EXAMINATIONS, 1969
AUGUST

CHEMISTRY 30

Time — 2 hours.

Total Possible Mark — 140.

NOTE — DO NOT SPEND TOO MUCH TIME ON ANY ONE QUESTION.
READ THE DIRECTIONS FOR EACH QUESTION CAREFULLY.

Knott's Mathematical Tables may be used. Slide rules are permitted.

Page 2A contains the Periodic Table. This page, for convenience, should be torn along the perforation for ready reference when required.

To ensure accuracy in the handling of your examination papers, the following sections on your answer sheet MUST BE COMPLETED.

SECTION A — Supply information as requested.

SECTION B — No label will be provided for the August examination. Indicate your name, mailing address and birth date in the space indicated.

SECTION C — Supply information as requested.

SECTION D — Disregard this section.

USE THE ATOMIC WEIGHTS SHOWN IN THE PERIODIC TABLE.

Gas constant, R = 0.0821 liter-atmospheres/degree-mole.

1 faraday = 96,500 coulombs.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE TEST BOOKLET.

Your presiding examiner will collect the answer sheet and booklet separately for transmission to the Department.

LB
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chem.30
CURR HIST

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All questions have a value of 2 marks each. In each case select the BEST of the four answers and record your choice on the separate answer sheet provided.

EXAMPLE	ANSWERS	ANSWER SHEET
The formula for sulphuric acid is	A. $H_2S_2O_7$ B. H_2SO_4 C. H_2SO_3 D. H_2SO_2	A ☐ B ■ C ☐ D ☐ E ☐ DISREGARD COLUMN "E" ON ANSWER SHEET

You are to use ORDINARY HB PENCIL to mark your answers on the answer sheet. Make sure that your answer marks are HEAVY and BLACK. If you change your mind about an answer, be sure to erase your first mark COMPLETELY. There must be no stray marks on your answer sheet and only one answer marked for each question.

1. How much ammonia, NH_3, can be made from 14 grams of nitrogen and 14 grams of hydrogen?

1.
A. 3.0 g
B. 17 g
C. 28 g
D. 34 g

2. The law which does not apply to the reaction in question 1 is

2.
A. conservation of mass
B. definite composition
C. multiple proportions
D. combining volumes

3. Consider the following atoms and ions:

F, F^-, Ne, Mg^{++}, Cl^-

Which of the following groups contains atoms and/or ions with the same electronic configurations?

3.
A. F, Ne, Cl^-
B. F, Ne, Mg^{++}
C. F^-, Ne, Mg^{++}
D. Cl^-, Ne, Mg^{++}

ROUGH WORK ONLY

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PERIODIC TABLE

PERIOD	GROUP 1A	2A	3B	4B	5B	6B	7B	← 8B →			1B	2B	GROUP 3A	4A	5A	6A	7A	GROUP 0
1										1 H 1.0								2 He 4.0
2	3 Li 6.9	4 Be 9.0	← TRANSITION ELEMENTS GROUP →										5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
3	11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.5	18 Ar 39.9
4	19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
5	37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc - - -	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
6	55 Cs 132.9	56 Ba 137.3	57-71 See La Series	72 Hf 178.5	73 Ta 181.0	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (210)	85 At - - -	86 Rn (222)
7	87 Fr - - -	88 Ra 226.0	89-103 See Ac Series															

La Series	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm - - -	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
Ac Series	89 Ac (227)	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np —	94 Pu —	95 Am —	96 Cm —	97 Bk —	98 Cf —	99 Es —	100 Fm —	101 Md —	102 No —	103 Lw —

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Questions 4 and 5 are based on the following reaction which represents the complete combustion of butane gas, C_4H_{10}:

$$2C_4H_{10(g)} + 13O_{2(g)} \longrightarrow 8CO_{2(g)} + 10H_2O_{(g)}$$

4. Air is one-fifth oxygen by volume. Assuming that all the gases involved are at STP calculate the VOLUME of AIR required to burn completely 29.0 grams of butane gas.

4.
A. 16.3 l
B. 72.8 l
C. 104 l
D. 364 l

5. Assuming that the reactants and products are at room temperature and pressure, then the volume of the products compared to the volume of the reactants is

5.
A. smaller
B. greater
C. the same
D. cannot be calculated

6. Element "X" has three isotopes of masses 10.0 a.m.u., 12.0 a.m.u. and 15.0 a.m.u. respectively. In a sample of gaseous "X" it was determined experimentally that these three isotopes were present in the ratio of 6 atoms of X – 10 to 3 atoms of X – 12 to 1 atom of X – 15. The calculated atomic weight of "X" is

6.
A. 10.0 a.m.u.
B. 10.6 a.m.u.
C. 11.1 a.m.u.
D. 12.3 a.m.u.

Questions 7 and 8 deal with an atom of germanium, ${}_{32}Ge^{73}$.

7. The total number of occupied orbitals in an atom of germanium in its ground state is

7.
A. 16
B. 17
C. 32
D. 73

8. The number of valence electrons in an atom of germanium is

8.
A. 2
B. 3
C. 4
D. 5

ROUGH WORK ONLY

9. $KClO_3$ undergoes disproportionation on heating. One of the products is KCl. The other product is

9. A. $KClO_4$
B. $KClO_2$
C. ClO_2
D. Cl_2

Questions 10 through 14 have to do with the following information:

Atoms A, B, C and D are the same period of the periodic table and have one, three, five and seven valence electrons respectively.

10. The atom with the highest second ionization potential is

10. A. A
B. B
C. C
D. D

11. The atoms with one unpaired electron in the ground state is

11. A. A, B and D only
B. A and D only
C. B and C only
D. A, B, C and D

12. Element D forms a diatomic molecule, D_2. The binding force between the molecules of the solid is

12. A. shared electrons
B. electrostatic attraction
C. dipole – dipole
D. van der Waals

13. The bond between C and D in a compound would most likely be

13. A. non-polar covalent
B. polar covalent
C. electrovalent
D. coordinate covalent

14. The formula for a compound of B and D would be

14. A. B_7D_3
B. B_3D
C. B_2D_3
D. BD_3

ROUGH WORK ONLY

Questions 15 through 17 refer to the following equation which is NOT balanced:

$$HgS + HCl + HNO_3 \longrightarrow H_2HgCl_4 + NO + S + H_2O$$

15. When the above reaction occurs, the atoms which change in oxidation number are

15.
A. S and N
B. Hg and Cl
C. N and Cl
D. Hg and S

16. When the above reaction is balanced which of the following statements is TRUE?

16.
A. The coefficient of H_2HgCl_4 is 3, and that of H_2O is 2
B. The coefficient of HgS is 3 and that of NO is one
C. The coefficient of HCl is 12 and that of H_2O is 4
D. None of these is correct

17. The reducing agent is

17.
A. HCl
B. HgS
C. N
D. HNO_3

18. Which one of the following is NOT an oxidation-reduction reaction?

18.
A. $BaO_2(s) + 2HCl \rightarrow BaCl_2 + H_2O_2$
B. $Zn(s) + Cu(NO_3)_2 \rightarrow Cu(s) + Zn(NO_3)_2$
C. $2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(g)$
D. $Fe_3O_4(s) + CO(g) \rightarrow 3FeO(s) + CO_2(g)$

19. $2NH_{3(g)} \rightarrow N_{2(g)} + 3H_{2(g)} - 22.0$ kcal.

According to this equation, during the decomposition of 85.0 grams of ammonia

19.
A. 55 kcal. of heat are produced
B. 55 kcal. of heat are required
C. 110 kcal. of heat are produced
D. 110 kcal. of heat are required

20. By experiment, a compound is found to have the molecular formula X_2O_5. It is also found that 16.5 grams of X combine with exactly 8.80 grams of oxygen. Find the atomic weight of X.

20.
A. 22.0 a.m.u.
B. 36.4 a.m.u.
C. 75.0 a.m.u.
D. 150 a.m.u.

ROUGH WORK ONLY

21. On analysis, the composition of a solid is found to be 26.59% potassium, 35.35% chromium and 38.08% oxygen by weight. Find the simplest formula of the compound.

21. A. $KCrO_2$
B. $KCrO_3$
C. $KCrO_4$
D. $K_2Cr_2O_7$

22. What is the molar volume of an ideal gas at 91.0° C and 84.0 cm. of Hg pressure?

22. A. 15.2
B. 18.6
C. 27.0
D. 33.0

23. The conditions under which real gases approximate ideal behavior are

23. A. low pressure and low temperature
B. high pressure and high temperature
C. low pressure and high temperature
D. high pressure and low temperature

24. 6.24 litres of a gas, at 27.0° C and 750 mm, of Hg pressure, weigh 27.0 grams. The gas is most likely

24. A. N_2O_5
B. $CHCl_3$
C. CH_3Br
D. OCl_2

25. The average speed of a molecule of $SO_2(g)$ at STP is 3000 cm. per sec. Calculate the average speed of a molecule of $CH_4(g)$ at STP.

25. A. 750 cm. per sec.
B. 1500 cm. per sec.
C. 6000 cm. per sec.
D. 12,000 cm. per sec.

26. In a closed container, there are 32.0 grams each of oxygen gas, O_2, sulphur dioxide gas, SO_2, and methane gas, CH_4. The combined pressures of these three gases is 700 mm of Hg. Calculate the partial pressure of methane.

26. A. 100 mm.
B. 233 mm.
C. 312 mm.
D. 400 mm.

ROUGH WORK ONLY

27. In order for a liquid to evaporate, which one of the following must be TRUE?

27.
A. Some molecules must have sufficient energy to overcome the attractive forces between the molecules.
B. The liquid must be in dynamic equilibrium with its vapor.
C. The vapor pressure must equal the atmospheric pressure.
D. The liquid must be non-polar.

Questions 28 and 29 refer to the following statements regarding LIQUIDS:

(1) The molecules are free to slide over one another.
(2) The molecules are close together so that their mutual attractions are strong.
(3) The mean free path of molecules is very short.
(4) Electron clouds of neighboring molecules repel one another.
(5) There is a perpetual exchange of energy between molecules.

28. Liquids are practically incompressible because

28.
A. 1
B. 2
C. 3
D. 4

29. Liquids diffuse slowly because

29.
A. 1 and 2 only
B. 2 and 3 only
C. 3 and 4 only
D. 4 and 5 only

Questions 30 and 31 are based on the following data:

The lattice structures of various solids may be described as having the following characteristics:

(1) molecules occupy the lattice points
(2) atoms occupy the lattice points
(3) positive and negative ions occupy the lattice points
(4) electrons are free to move throughout the crystal
(5) electron pairs are shared equally between neighboring atoms

30. Covalent solids are characterized by

30.
A. 1 only
B. 2 and 5 only
C. 3 and 4 only
D. 5 only

31. Ionic solids are characterized by

31.
A. 1 and 5 only
B. 2 and 4 only
C. 3 only
D. 5 only

ROUGH WORK ONLY

Questions 32 and 33 refer to the following statement:

Some properties of solids are:

(1) low melting point
(2) high melting point
(3) non-conductivity
(4) good conductivity
(5) softness
(6) hardness
(7) high volatility

32. Weak binding forces in molecular solids result in

32.
A. 1, 5 and 7
B. 1, 4 and 7
C. 2, 4 and 5
D. 2, 3 and 5

33. Electron pairs shared equally between adjacent atoms result in

33.
A. 1, 3 and 5
B. 2 and 6 only
C. 1, 5 and 7
D. 2, 3 and 6

34. A correct formula for the hydronium ion is

34.
A. H_3O^+
B. OH^-
C. H^+
D. H_3O^-

35. Which of the following is NOT an acceptable way of showing the electrolytic dissociation of water?

35.
A. $H_2O \longrightarrow H^+ + OH^-$
B. $H_2O \longrightarrow 2H^+ + O^{-2}$
C. $H_2O + H_2O \longrightarrow H_3O^+ + OH^-$
D. $2H_2O \longrightarrow 2H^+ + 2OH^-$

36. The dissolving of sodium hydroxide in water is an exothermic reaction. This statement allows us to conclude that

36.
A. the heat of solution is positive
B. if the water is heated, the solubility of the solid will increase
C. the lattice energy is greater than the hydration energy
D. the precipitation process is exothermic

ROUGH WORK ONLY

37. If one mole of H_3PO_4 reacts with one mole of KOH, and the solution is evaporated to dryness, the residue will be

37. A. KPO_4^{-2}
B. K_2HPO_4
C. KH_2PO_4
D. K_3PO_4

38. What volume of 2.5 M HCl must be mixed with 400 ml. of 1.0 M HCl to produce a solution which is 2.0 M?

38. A. 800 ml.
B. 320 ml.
C. 160 ml.
D. none of these

39. By titration it is found that 40.2 ml. of 0.20 N NaOH exactly neutralize 37.6 ml. of H_2SO_4. What is the concentration of the acid?

39. A. 0.428 N
B. 0.053 N
C. 0.214 M
D. 0.107 M

40. Which of the following statements regarding galvanic and electrolytic cells are TRUE?

(1) An electrolytic cell uses electrical energy to produce a chemical change.
(2) A galvanic cell uses electrical energy to produce a chemical change.
(3) Oxidation occurs at the cathode.
(4) A galvanic cell and a voltaic cell are different names for the same thing.
(5) A galvanic cell uses chemical energy to produce an electric current.

40. A. 4 and 5 only
B. 2 and 4 only
C. 1, 3 and 4 only
D. 1, 4 and 5 only

41. As the temperature of a metallic conductor increases, its conductivity decreases because

41. A. the increasing vibration of the positive ions interfere with the migration of electrons
B. the increase in temperature causes the molecules to expand, leaving smaller spaces between them
C. the increase in temperature causes the positive and negative ions to migrate in a more random manner
D. at a higher temperature the electrons have more energy and interfere with one another

ROUGH WORK ONLY

Questions 42 through 45 refer to the following hypothetical reaction together with the data table:

$$2P + 3Q + R \longrightarrow T + 2U$$

Experiment No.	Initial Molar Concentration × 10^2			Initial Rate of Formation of T, M/min
	P	Q	R	
1	1.0	1.0	1.0	3.0
2	1.0	2.0	2.0	6.0
3	1.0	2.0	3.0	6.0
4	1.0	3.0	4.0	9.0
5	2.0	3.0	5.0	36.0
6	3.0	3.0	6.0	81.0

42. Tripling the concentration of R

42. A. doubles the rate
B. triples the rate
C. quadruples the rate
D. has no effect on the rate

43. Doubling the concentration of Q increases the rate of formation of T by a factor of

43. A. 2
B. 3
C. 4
D. 8

44. The rate of formation of T is equal to

44. A. $k[P]^2\ [Q]^3\ [R]$
B. $k[P]^2\ [Q]\ [R]$
C. $k[P]^2[Q]$
D. $k[P][Q]$

45. Suppose that one more experiment was carried out, in which the concentration of P, Q, and R became 6.0, 6.0 and 12.0 respectively. The rate of formation of T would then be

45. A. 162 M/min
B. 324 M/min
C. 432 M/min
D. 648 M/min

ROUGH WORK ONLY

Questions 46 through 48 are based on the following half-reactions and their oxidation potentials.

		Volts
(1)	$Fe(s) \longrightarrow Fe^{+2} + 2e^-$	+ 0.44
(2)	$Mg(s) \longrightarrow Mg^{+2} + 2e^-$	+ 2.37
(3)	$2Cl^- \longrightarrow Cl_2(g) + 2e^-$	−1.36
(4)	$Ag(s) \longrightarrow Ag^+ + e^-$	−0.80

46. The cell which would provide the greatest voltage would be made using

46. A. 1 and 4
B. 1 and 3
C. 2 and 4
D. 2 and 3

47. If a galvanic cell were built using half-reactions 1 and 3, the over-all cell reaction would be shown by the equation

47. A. $Fe^{+2} + Cl_2 \longrightarrow Fe(s) + 2Cl^-$
B. $Fe(s) + Cl_2 \longrightarrow Fe^{+2} + 2Cl^-$
C. $Fe(s) + 2Cl^- \longrightarrow Fe^{+2} + Cl_2(g)$
D. $Fe^{+2} + 2Cl^- \longrightarrow FeCl_2(s)$

48. The best reducing agent in the above table is

48. A. $Mg(s)$
B. Mg^{+2}
C. Cl^-
D. $Cl_2(g)$

ROUGH WORK ONLY

Before answering questions 49 and 50, complete and balance the following skeleton equation:

$$Zn(s) + As_2O_3 \longrightarrow Zn^{++} + AsH_3 \qquad \text{(acidic)}$$

49. In the balanced equation

49.
A. there are 18 water molecules
B. there are 6 zinc ions
C. the sum of the coefficient is 29
D. none of the above is correct

50. The total electron exchange is

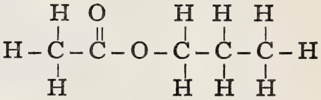
50.
A. 12 electrons
B. 6 electrons
C. 2 electrons
D. none of these

51. An electric current is passed through 80.0 ml of 0.50 M solution of magnesium bromide, $MgBr_2$, yielding bromide gas at one of the electrodes. The process is stopped after 0.0020 faraday have been used. Assume that there is no change in volume. What is the final concentration of bromide ions?

51.
A. 0.98 M
B. 0.48 M
C. 0.025 M
D. 0.0020 M

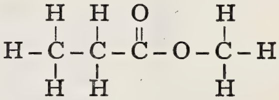
52. The correct structural formula for methyl propionate is

52. A.



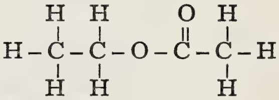
$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\overset{\overset{O}{\|}}{C}-O-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H$$

B.



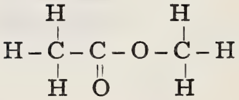
$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\overset{\overset{O}{\|}}{C}-O-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H$$

C.



$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-O-\overset{\overset{O}{\|}}{C}-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H$$

D.



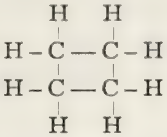
$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{O}{\|}}{C}-O-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H$$

ROUGH WORK ONLY

53. Which one of the following hydrocarbons reacts with bromine by substitution?

53. A. ethylene, C_2H_4
B. acetylene, C_2H_2
C. cyclohexene, C_6H_{10}
D. benzene, C_6H_6

54. The structural formula for cyclobutane is



Which of the following is an isomer?

54. A. butane
B. butene
C. butyne
D. butadiene

55. The giant sheet-like graphite molecules are held together by forces called

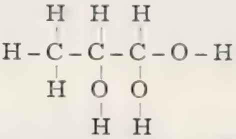
55. A. covalent forces
B. electrovalent forces
C. van der Waals forces
D. coordinate covalent forces

56. When an alcohol which has its functional group on a terminal carbon atom, is partially oxidized, the product is called

56. A. a ketone
B. an ether
C. an aldehyde
D. an alkene

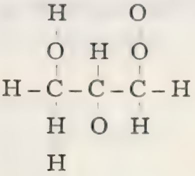
57. Glycerine is an alcohol containing three alcohol functional groups. Which one of these structural formulas is INCORRECT?

57. A.



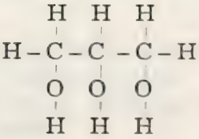
$$\begin{array}{ccccccccccc} & & H & & H & & H & & & & \\ & & | & & | & & | & & & & \\ H & - & C & - & C & - & C & - & O & - & H \\ & & | & & | & & | & & & & \\ & & H & & O & & O & & & & \\ & & & & | & & | & & & & \\ & & & & H & & H & & & & \end{array}$$

B.



$$\begin{array}{ccccccccc} & & H & & & & O & & \\ & & | & & & & & & \\ & & O & & H & & O & & \\ & & | & & | & & | & & \\ H & - & C & - & C & - & C & - & H \\ & & | & & | & & | & & \\ & & H & & O & & H & & \\ & & & & & & & & \\ & & H & & & & & & \end{array}$$

C.



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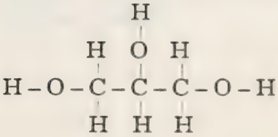
D.



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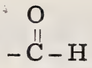
ROUGH WORK ONLY

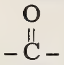
58. Which functional group is characterized by ketones?

58. A.



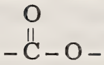
$-\overset{\overset{\textstyle O}{\|}}{C}-H$

B.



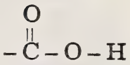
$-\overset{\overset{\textstyle O}{\|}}{C}-$

C.



$-\overset{\overset{\textstyle O}{\|}}{C}-O-$

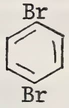
D.



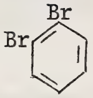
$-\overset{\overset{\textstyle O}{\|}}{C}-O-H$

59. The formula for orthodibromobenzene is

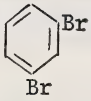
59. A.



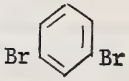
B.



C.



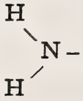
D.



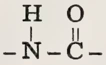
60. The characteristic feature of all PROTEINS is the group

60. A. H − N = C <

B.

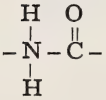


C.



$-\overset{\overset{\textstyle H}{|}}{N}-\overset{\overset{\textstyle O}{\|}}{C}-$

D.



$-\underset{\underset{\textstyle H}{|}}{\overset{\overset{\textstyle H}{|}}{N}}-\overset{\overset{\textstyle O}{\|}}{C}-$

ROUGH WORK ONLY

Questions 61 and 62 are based on the experiment to determine by titration the concentration of an acid solution.

61. The purpose of using $KHC_8H_4O_4$ was

61. A. to remove any impurities from the sodium hydroxide solution before titrating it against the acid
B. to rinse the apparatus before carrying out the titration
C. to titrate against the hydrochloric acid solution and hence find its concentration
D. to determine accurately the concentration of the sodium hydroxide solution

62. If, in the burette, air was present in tube below the clamp when the initial volume of the base was read, and was not present after the titration, what affect would this have on the calculated concentration of the acid?

62. A. The real concentration would be higher than the calculated value.
B. The real concentration would be lower than the calculated value.
C. The error would cancel out, and the calculated value would be correct
D. Since the air bubble is below the clamp, it would have no effect

Questions 63 through 65 are based on results obtained in Experiment 19 on "OXIDATION REDUCTION REACTIONS". In this experiment, chlorine water was added to each of three test tubes containing respectively water solution of NaCl, NaBr and NaI. Then 1.0 ml. of CCl_4 was added to each test tube and the test tube was shaken.

63. Which solution appeared to give a reaction when the chlorine water was added?

63. A. the NaCl only
B. the NaI and the NaBr only
C. the NaI and the NaCl only
D. the NaBr only

64. After the CCl_4 settled to the bottom of the test tube containing the NaI and Cl_2 water, the CCl_4 was

64. A. colorless
B. greenish-yellow
C. amber
D. violet

65. CCl_4 in the above experiment is

65. A. an oxidizing agent
B. a reducing agent
C. both an oxidizing and a reducing agent
D. neither an oxidizing nor a reducing agent

ROUGH WORK ONLY

66. In Experiment 25, "SOME ORGANIC REACTIONS", a heated coil of copper wire was held above 2 ml. of ethyl alcohol until a change in odor was noted. Then the liquid was poured into a test tube containing $K_2Cr_2O_7$ dissolved in 6 M H_2SO_4. The substance finally formed was

66. A. diethyl ether
B. acetaldehyde (ethanal)
C. acetic acid (ethanoic acid)
D. formaldehyde (methanal)

Questions 67 through 70 deal with the following experiment of analysis:

A student was given a solution which contained all of the following ions:

Ag^+, Al^{+3}, Hg_2^{+2}, Fe^{+3}, Ca^{+2}

He was then asked to separate these ions to identify them by certain color changes and precipitates.

67. The reagent used to separate Ag^+ and Hg_2^{++} ions from the other three types was

67. A. NH_4OH
B. HCl
C. H_2S
D. H_2SO_4

68. During the course of the analysis, the ion which formed a red-brown precipitate with dilute NH_4OH was

68. A. Fe^{+3}
B. Al^{+3}
C. Ca^{+2}
D. Hg^{+2}

69. A flame test was used to identify

69. A. Ag^+
B. Fe^{+3}
C. Ca^{+2}
D. Hg_2^{+2}

70. A solution of $K_4Fe(CN)_6$ was used to confirm the presence of

70. A. Ag^+
B. Al^{+3}
C. Ca^{+2}
D. Fe^{+3}

ROUGH WORK ONLY

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